

on the lake; 25th, the lake, as observed from this place, appeared to be covered with ice, and also on the 30th.

Sandusky bay.—Sandusky, Ohio: during the afternoon of the 14th, the ice in the bay began to move slowly, and on the 15th, the bay was entirely free of ice; but it again froze over on the 20th.

Delaware and Raritan canal.—Bordentown, New Jersey: 12th, canal navigation open; numerous arrivals on this date from Baltimore and Philadelphia, bound to New York.

Maumee river.—Toledo, Ohio: floating ice on the 1st, 3d, 5th; river frozen, 7th. On the 21st, the river was covered with ice from one to two inches thick. On the 27th, the river at Toledo was nearly free of ice, but at points below it was still frozen. On the 30th, the ice was disappearing rapidly.

Cuyahoga river.—Cleveland, Ohio: 8th and 9th, river was frozen during the morning but was opened by tugs; 14th, ice became detached from the shores and moved out. On the 21st, the river was again frozen; and was opened by tugs on the 24th.

Lake Erie.—Cleveland, Ohio: 19th, lake was filled with floating ice; on the 20th, it was frozen for a distance of one mile from the shore.

Detroit river.—Detroit, Michigan: drift-ice in river from 1st to 31st.

Lake Michigan.—Grand Haven: the steamer "Wisconsin" was fast in the ice, six miles north of the outer piers, from the 8th to 18th; on the latter date she was loosened from the ice-fields during a storm and arrived at Grand Haven in the afternoon. Captain McGregor reported that the ice was from twenty to thirty feet in thickness for a distance of from four to six miles, and that the ice-fields extended lakeward for a distance of from twenty to twenty-five miles. The "Wisconsin," although laden with nine hundred tons of freight, was lifted one foot above the water a few hours before being loosened from the ice. The steamer "Michigan" left harbor on the 18th for Milwaukee, and was caught in the ice about three miles off this port and is supposed to have drifted southward with the moving ice-fields.

Milwaukee, Wisconsin: Captain McIntyre, of the Goodrich transportation company, arrived during the morning of the 20th and reported that his boat was caught in the ice-fields for twelve days, six miles north of Grand Haven. The ice extended as far south as Holland, Michigan; it was from fifteen to eighteen miles wide and thirty feet in depth.

Lake Huron and Saint Clair river.—Port Huron, Michigan: the ice-bridge at Fort Gratiot light-house and the ice-dam opposite the lower end of the city broke during the morning of the 2d. There was heavy floating ice in the river on the 5th, 11th, 15th, and 28th. On the night of the 19th–20th, a second ice-bridge formed near Fort Gratiot light-house at the base of Lake Huron. On the 27th, solid ice extended out into the lake as far as the eye could reach, and also on the 31st.

Little Bay de Noquet.—Escanaba, Michigan: bay frozen from 1st to 31st.

Lake Superior.—Duluth, Minnesota: all ice moved out on the 24th; lake frozen as far as the eye could reach on the 28th.

Mississippi river.—Saint Paul, Minnesota: river frozen from 1st to 31st.

La Crosse, Wisconsin: river frozen from 1st to 31st; teams crossed on the ice up to 13th.

Dubuque, Iowa: on the 2d, the ice was about fifteen inches thick, and afforded safe transit for teams. At 10 a. m. of the 8th, the ice broke below the railroad-bridge, but teams continued to cross opposite the levee. The ice melted rapidly on the 14th, and on the 16th, an ice-dam formed on the islands below the city. On the 24th, the ice-dam above the bridge gave way. The river was free from ice except along the shore on the 28th, and on the 29th, the steamer "Keokuk" arrived from Saint Louis, being twenty-seven days later than the first arrival of 1882. Floating ice continued on the 29th, 30th, 31st.

Davenport, Iowa: the ice moved slightly on the rapids during the afternoon of the 2d; and on the 9th, the ice above the

bridge moved about one-half mile. On the 13th and 14th, an ice-dam formed at the islands below the city. The ice-dam broke on the 17th; and floating ice continued until the 21st. The steamer "J. W. Mills," (the first boat of season) arrived on the 27th.

Burlington, Iowa: the ice began to move on the 1st, and continued during the 2d. The first boat of the season arrived on the 15th.

Keokuk, Iowa: the ice broke up during the afternoon of the 1st. The steamer "Keokuk" from Saint Louis arrived on the 5th, being the first boat of the season.

Maquoketa river.—Monticello, Iowa: the ice moved out of the river on the 18th; it had been closed since December 6th, 1882—one hundred and two days. The ferry-boat began running on the 19th.

Des Moines river.—Des Moines, Iowa: the ice broke in the river on the 12th, and by the 23d the river was clear of ice.

Humboldt, Iowa: on the 12th, the ice broke up in the river between this place and Fort Dodge, a distance of twenty miles. On the 17th, the river was free from ice.

Republican river.—Clay Centre, Kansas: the ice moved out of river on the 1st.

Missouri river.—Fort Benton, Montana: the ice in the river at this place broke up at 10 a. m. of the 5th.

Fort Bennett, Dakota: ice broke up during the afternoon of the 17th.

Fort Hale, Dakota: river opened at this place on the 17th.

Fort Randall, Dakota: ice broke during the afternoon of the 21st.

Yankton, Dakota: the ice began to move at 4.50 p. m. of the 4th, but remained solid until the afternoon of the 13th, when it broke up. Ferry-boats first crossed the river on the 21st.

Omaha, Nebraska: river opened on the 9th.

Leavenworth, Kansas: floating ice from 1st to 8th, 12th, 22d, 27th to 31st.

Yellowstone river.—Billings, Montana: ice broke up during the afternoon of the 17th.

Terry's Landing, Montana: river opened on 13th.

Fort Keogh, Montana: river opened on 12th.

Gleedive, Montana: the ice broke up and moved out without damage at 3 p. m. of the 17th.

Tongue river.—Fort Keogh, Montana: river opened on 2d.

Miscellaneous.—Reports from Saint John, New Brunswick, on the 21st, stated that Mines Basin, Nova Scotia, was blocked with immense ice-fields extending from shore to shore. In the centre of the basin the ice had formed into lumps of more than ten feet in thickness and weighing many tons.

Dyberry, Pennsylvania: on the 5th, the ice on ponds in this vicinity was twenty-five inches thick.

Catawissa, Pennsylvania: navigation on the North Branch canal opened on the 31st.

WATER-SPOUTS.

The Chief Signal Officer has received from Captain A. W. Jeffery, of the s. s. "Ptolemy," an interesting letter, together with an illustration concerning a water-spout which was observed at 7 a. m. of February 10, 1883, in latitude S. 7°, longitude W. 34°.

The water-spout traveled in a westerly direction at about the rate of twenty miles per hour. The edges of the column were well-defined and seemed semi-transparent. The spiral column was a modified form of the nimbus cloud, and the well-defined edges seemed nothing but rain. As the rain became exhausted from the cloud, the column gradually diminished and finally ascended into the cloud.

Captain Jeffery states that, in his opinion, the danger from water-spouts does not arise from the deluge of water, but from the strength of the whirlwind against the canvas of the vessel.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors

at the Signal-Service stations, with the average depth at which the observations were made, are given in the table below, with monthly ranges of water-temperatures and the mean temperature of the air at the various stations. Observations were interrupted by ice at the following stations: Sandusky, Ohio, from the 1st to 14th, and from the 20th to 31st; Cleveland, Ohio, from 1st to 16th, and from 19th to 31st; Duluth, Minnesota, from 1st to 23d, and 28th to 31.

The largest monthly ranges of water-temperature are: Galveston, Texas, 15°; Indianola, Texas, 13°·7; Key West, Florida, 11°·6; Cedar Keys, Florida, 11°; Sandy Hook, New Jersey, 10°·6. The smallest are: Eastport, Maine, 1°·6; Wilmington, North Carolina, 3°; Portland, Oregon, 3°·5; San Francisco, California, 3°·8; Baltimore, Maryland, 4°; New London, Connecticut, 4°.

Temperature of Water for March, 1883.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey	40.0	34.5	5.5	6 0	35.0
Alpena, Michigan*	60.0	50.5	9.5	9 0	53.8
Augusta, Georgia	42.	35.0	4.0	9 5	39.4
Baltimore, Maryland	39.7	30.3	9.4	5 7	32.6
Block Island, Rhode Island	34.0	28.0	6.0	25 0	31.3
Boston, Massachusetts					
Buffalo, New York*	71.0	60.0	11.0	10 2	61.3
Cedar Keys, Florida	58.5	53.4	5.1	39 10	53.8
Charleston, South Carolina					
Chicago, Illinois*	47.5	38.0	9.5	5 8	38.7
Chincoteague, Virginia	34.3	34.2		14 0	28.4
Cleveland, Ohio†					
Detroit, Michigan*	41.3	36.1	5.2	6 2	37.0
Delaware Breakwater, Delaware	35.2	33.6		15 8	22.6
Duluth, Minnesota†	32.2	30.6	1.6	16 9	23.6
Eastport, Maine					
Esacnaba, Michigan*	61.0	46.0	15.0	14 8	62.4
Galveston, Texas	36.6	29.0	7.6	19 0	27.3
Grand Haven, Michigan	71.5	57.8	13.7	9 1	64.0
Indianola, Texas	66.0	60.0	6.0	18 0	60.4
Jacksonville, Florida	81.4	69.8	11.6	16 9	72.7
Key West, Florida					
Mackinaw City, Michigan*					
Marquette, Michigan*					
Milwaukee, Wisconsin*	63.5	55.0	8.5	16 3	57.7
Mobile, Alabama	38.6	30.6	8.0	14 3	29.9
New Haven, Connecticut	38.0	34.0	4.0	12 8	32.2
New London, Connecticut	38.5	31.7	6.8	10 5	32.0
Newport, Rhode Island	37.7	31.7	6.0	10 5	33.6
New York City	51.0	42.0	9.0	17 2	44.8
Norfolk, Virginia	66.8	56.9	9.9	17 9	58.0
Pensacola, Florida	34.5	31.0	3.5	18 0	28.9
Portland, Maine	48.0	40.2	7.8	47 4	50.4
Portland, Oregon	55.0	45.7	9.3	9 11	60.8
Port Eads, Louisiana	30.0	30.5	5.5	14 0	30.1
Provincetown, Massachusetts	75.0	66.6	8.4	11 3	67.1
Punta Rassa, Florida	32.6	31.6		10 0	31.2
Sandusky, Ohio†	42.8	32.2	10.6	1 4	34.4
Sandy Hook, New Jersey	54.6	50.8	3.8	29 5	53.0
San Francisco, California	58.0	53.0	5.0	13 7	57.1
Savannah, Georgia	58.0	49.0	9.0	10 0	48.8
Smithville, North Carolina					
Toledo, Ohio*	53.0	50.0	3.0	13 0	50.8
Wilmington, North Carolina					

* Frozen throughout month. † Observations incomplete. See text.

ATMOSPHERIC ELECTRICITY.

AURORAS.

On the evening of March 1st an auroral display was observed at stations in New England, and from the upper lake region westward to Montana; the most southerly stations reporting the display being in Nebraska and Iowa. This display, although extensively observed, was not brilliant.

On the 2d, a display was reported from stations in the upper lake region, extreme northwest, and the upper Mississippi valley. At Burlington, Vermont, it was observed in the form of a bright yellow light, with a few streamers, from 9 to 11 p. m., and continued until 12.20 a. m. of the 3d. It extended from 15° east to 25° west of north and to an altitude of 25°. At 11.25 p. m. streamers of a variety of colors rose to an altitude of 45°. At Saint Vincent, Minnesota, the display was faint and continued from 8 p. m. until the morning of the 3d. It appeared in the form of two arches separated by a space of about 5°. The most southerly station reporting this display was Monticello, Iowa.

On the 3d, a faint display was generally observed in New

England, the upper lake region and upper Mississippi valley, and was also reported to have been seen at Barnegat City, New Jersey; Emmitsburg, Maryland, and Red Willow, Nebraska. Other displays were observed as follows:—On the 4th, at stations in the upper lake region and in New England; 6th, in the upper lake region, upper Mississippi valley and extreme northwest; 7th, from New England westward to the extreme northwest; 8th, from New England westward to Dakota—this display was also observed at San Francisco, California; 9th, in New England and the lower lakes; 12th, in the upper lake region and upper Mississippi valley, Montana, Wyoming and Washington Territory; 13th, in New England, northern Illinois, Iowa and eastern Nebraska; 15th, at Clay Centre, Kansas, Franklin, Wisconsin, and Clear Creek, Nebraska; 17th, Clear Creek, Nebraska; 18th, at Wellsboro, Pennsylvania; 19th, Cedar Rapids, Iowa; 21st, Bordentown, New Jersey, and Fort Brady, Michigan; from the 25th to 31st, auroras of more or less brilliancy were of nightly occurrence; on the 31st, a bright display was observed at Kiantone, New York. On the 18th, at Denison, Texas, an auroral light was reported to have been seen through the broken clouds from 7.15 to 8.30 p. m.

At Mobile, Alabama, on the 22d, between 10.30 and 11.20 p. m., there were observed in the northern sky, three luminous beams of pale yellow light. These bands had a gradual lateral motion from east to west, cutting the magnetic meridian at nearly right angles. At the same time a single luminous band was observed in the southwestern sky.

Captain J. T. Hein, of the s. s. "Hermod," reported: On the 9th, at 8 p. m., in about N. 45°, W. 42°, observed a brilliant northern light, lasting until 11 p. m. The air was filled with electricity during that time, and every point and wire-ropes—even the edges of the smoke-stack—were illuminated by it.

ATMOSPHERIC ELECTRICITY INTERRUPTING TELEGRAPHIC COMMUNICATION.

Fort Supply, Indian Territory, 15th.
Coleman City, Texas, 23d.
Prescott, Arizona, 10th.

THUNDER-STORMS.

Thunder-storms were reported in the various states and territories, as follows:—

Alabama.—Auburn, 19th; Montgomery, 19th, 24th, 25th; Mobile, 24th.

Arizona.—Yuma, 1st, 2d, 12th, 15th, 17th; Prescott, 7th, 10th, 13th to 16th, 29th; Tucson, 9th, 23d; Apache Pass, 11th; Fort Apache, 16th, 29th, 30th.

Arkansas.—Fort Smith, 15th, 18th, 30th; Mount Ida, 23d, 29th; Little Rock, 30th.

California.—San Diego, 1st; Poway, 1st, 3d, 5th, 6th; Princeton, 12th; Fort Yuma, 15th; Sacramento, 27th; San Francisco, 28th; Visalia, 27th 28th.

Colorado.—Fort Collins, 28th, 30th; Denver, 29th.

Connecticut.—Bethel, 19th, 20th; New Haven, 20th; Southington, 20th.

Delaware.—Delaware Breakwater, 19th.

Florida.—Punta Rassa, 8th, 11th, 20th, 25th; Pensacola, 8th, 24th, 25th; Cedar Keys, 19th, 25th; Key West, 20th, 25th, 30th; Jacksonville, 31st; Sanford, 31st.

Georgia.—Forsyth, 15th, 19th, 20th, 31st; Augusta, 19th, 30th, 31st; Atlanta, 19th, 30th; Savannah, 19th.

Idaho.—Lewiston, 28th, 30th; Fort Lapwai, 28th.

Illinois.—They were reported by numerous stations throughout the state on the 13th, 14th, 28th, 29th, 30th, and at Anna, 6th; Swanwick, 6th; Cairo, 15th, 31st.

Indiana.—Lafayette, 5th; New Harmony, 6th; Logansport, 12th; Laconia, 30th; and of general occurrence throughout the state on the 14th.

Indian Territory.—Fort Supply, 15th, 23d.

Iowa.—Keokuk, 13th; Monticello, 13th.